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JC13 Rec'd PCT/PTO 22 FEB 20

U.S. APPLICATION NO. 10/069686		INTERNATIONAL APPLICATION NO. PCT/GB00/01844		ATTORNEY'S DOCKET NUMBER Eryurtlu-3	
21. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO . . . \$1040.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO . . . \$890.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO . . . \$740.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) . . . \$710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) . . . \$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT =				CALCULATIONS PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	
Total claims	5 - 20 =		x \$18.00	\$	
Independent claims	1 - 3 =		x \$84.00	\$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ \$280.00 \$	
TOTAL OF ABOVE CALCULATIONS =				\$ 890.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27 The fees indicated above are reduced by 1/2.				\$	
SUBTOTAL =				\$ 890.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$ 890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$ 40.00	
TOTAL FEES ENCLOSED =				\$ 930.00	
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NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO:					
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> Docket Administrator Lucent Technologies Inc. Room 3J-219 101 Crawfords Corner Rd. Holmdel, NJ 07733-3030 </div> <div style="width: 50%; text-align: right;">  SIGNATURE Gregory J. Murgia NAME 41209 REGISTRATION NUMBER </div> </div>					

IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

Patent Application

Inventor(s) Faruk Mehmet Eryurtlu
Case 3
Serial No. Group Art
File Date
Examiner
Title VIDEO SIGNAL ERROR DETECTION SYSTEMS

ASSISTANT COMMISSIONER FOR PATENTS AND TRADEMARK
WASHINGTON, DC 20231

Dear Sir:

PRELIMINARY AMENDMENT

The version of the claims showing the changes made to the claims of the application are attached for your review.

In The Claims:

Please replace claim 3 as follows:

3. (amended) A system according to Claim 1, wherein the first comparator acts as a mode decision circuit capable of generating one of three outcomes namely, inter-frame prediction, no inter-frame prediction and unknown.


REMARKS

By way of the Preliminary Amendment, Applicant has amended claim 3 in the above-identified application in accordance with typical U.S. patent practice. In the event of any fees inadvertently omitted or any improper payment of fees, the Commissioner is hereby authorized to charge or credit Lucent Technologies Deposit Account No.12-2325

to correct the error now or during the pendency of this application, except for the issue fee.

If the Examiner has any questions or feels that a telephone conversation would be helpful, please contact Julio Garceran at (973) 386-2286.

Respectfully submitted,
Faruk Mehmet Eryurtlu

By: 
Julio A. Garceran, Attorney
Reg. No. 37,138

Lucent Technologies Inc.

Date: 1/3/02

VERSION OF CLAIMS SHOWING CHANGES

3. (amended) A system according to Claim 1 [or to Claim 2], wherein the first comparator acts as a mode decision circuit capable of generating one of three outcomes namely, inter-frame prediction, no inter-frame prediction and unknown.

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Revised PCT/PTO 22 FEB 2002

VIDEO SIGNAL ERROR DETECTION SYSTEMS

The present invention relates to video signal error detection systems.

5 Mobile phones now have the facility to transmit and receive video signals so that the communicating parties can view each other while speaking.

Because of restricted bandwidths, the signals are transmitted at low bit rates. Because mobile phone networks are now so extensive and the transmission medium is air,
10 the transmitted signals are more susceptible to corruption, for example, due to channel errors. Accordingly, there is a need to check received video signals for errors.

The video signals are usually transmitted in a succession of successive macroblocks. Each macroblock may comprise a block of 16 x 16 pixels of a picture frame. A simple
15 error check may be carried out in the mobile phone receiving the signal, by counting the coefficients in the macroblock. In a 16 x 16 macroblock there will be a maximum of 256 coefficients and, if more are counted, it can be assumed that an error has occurred. In this event, the macroblock being received may be suppressed and replaced by the corresponding block in the previous frame or other error concealment techniques may be used.

20

However, other errors may not be so easy to detect.

It is an object of the invention to provide an improved video signal error detection

system.

According to the present invention there is provided a video signal error detection system for use in a receiver having a decoder for receiving encoded video signals produced by an encoder in a transmitter, the encoder being selectively operative to transmit only differences between selected macroblocks in successive frames when a specific difference criteria between said successive blocks is not exceeded, the detection system comprising a first comparator for comparing macroblocks in successive frames in the output signal from said decoder, applying said specific difference criteria to provide an indication of whether inter-frame prediction should apply or not, and a second comparator for comparing the output from the first comparator with an output from the decoder indicative of whether or not the last macroblock received was in inter-frame prediction format or not and operable to generate an error signal when a divergence is detected.

The video signal error detection system embodying the present invention, will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a block diagram of a video transmission system; and

Figure 2 is a block diagram of a video reception system.

20

The video transmission system shown in Figure 1 comprises a video camera 2 which generates a video output signal representative of a picture frame.

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The output of the camera 2 is fed to an encoder 8. The output of the encoder 8 is fed via a delay circuit 4 to a buffer memory 6 and directly to a transmitter 10 which transmits the signal via an antenna 12 to a remote station. The encoder 8 compares the current picture frame signals being received from the camera 2 with the immediately preceding picture frame signals as stored in the buffer memory 6.

The encoder 8 exploits the correlation between successive frames. The current video coding standards use block matching motion compensation technique for inter-frame prediction. In this approach, if the current picture block is similar to another block in the previous frame (picture) within the search area, the displacement (motion) vector and the difference between those two blocks are encoded (INTER mode). Otherwise, the current picture is encoded without any inter-frame prediction (INTRA mode).

Each block, hereinafter called a macroblock, may comprise a 16×16 pixel block.

The video reception system, shown in Figure 2, includes an antenna 14 which feeds a receiver 16. The output of the receiver 16 is fed to a decoder 18. The decoder 18 decodes the bit stream which also includes a mode indicator signal from the receiver. This mode information is fed to a mode decision circuit 24. The reconstructed picture is fed to an error concealment circuit 28, and also to a buffer 22 so that the buffer 22 is always updated to provide the previous (the immediately preceding) picture frame.

The output of the error concealment circuit 28 is displayed on a visual display unit

(VDU) 20.

The mode decision circuit 24 responds to the output of the decoder 18 and the buffer 22 to carry out a similar decision making process to that carried out in the encoder 8 ie it tries to predict whether the two macroblocks being compared qualify for INTER or INTRA mode treatment. A comparison circuit 26 then compares the output of the decision circuit with the mode indicator from the decoder 18. If concordance is not detected, there is a strong possibility of error. The error concealment circuit 28 tries to recover corrupted data if an error indication is signalled from the comparison circuit 26, using established techniques.

The mode decision circuit 24 may be constructed in a manner similar to the video codec test model Version 8 (TMN8) described by Thomas R Gardos in the proceedings of the video coding experts group question 15 (Q15-A-59) Portland 24-27 June 1997, which material is incorporated herein by reference.

In TMN8, the following parameters are calculated to make the INTRA/INTER decision:

$$MB_mean = \left(\sum_{i=1, j=1}^{16, 16} original(i, j) \right) / 256$$

$$A = \sum_{i=1, j=1}^{16, 16} |original(i, j) - MB_mean|$$

- 5 -

INTRA mode is chosen if $A < B$

Where,

$$B = \sum_{i=1, j=1}^{16,16} | \text{original}(i,j) - \text{previous}(i,j) | - \beta$$

$$\beta = \{ 600 \text{ mv} = 0$$

$$\{ 500 \text{ mv} \neq 0$$

10

The parameter *previous* (*i,j*) corresponds to the best match block in the previous frame used for motion compensation, and *mv* is the motion vector.

Since the decoder does not have the original values, the term “original” has to be replaced by the term “reconstructed”. The change from two-outcome to three-outcome case is achieved by considering an error margin E due to the problems discussed above:

INTRA mode if $A < B - E$

UNKNOWN if $B - E < A < B + E$

20

INTER mode if $B + E < A$

A mode change from INTER to INTRA (or vice versa) indicates that the current block is corrupted, and therefore appropriate error concealment techniques should be used,

such as the one hereinbefore described.

Obviously, the value of E should be tuned depending on the system in use. It is a trade-off between the accuracy and rate of detection of the corruption blocks. If the decoder and encoder both employ the same method for mode selection, then a smaller E can be selected.

The difference between the original and decoded pixel values depending on the quantization parameter q . Therefore, E should be a function of q . This function should be determined by considering the quantizer. For the TMN8 quantizer, E value is defined as follows:

$$E = \begin{cases} 256 & \text{if } q < 4 \\ 64q & \text{if } q \geq 4 \end{cases}$$

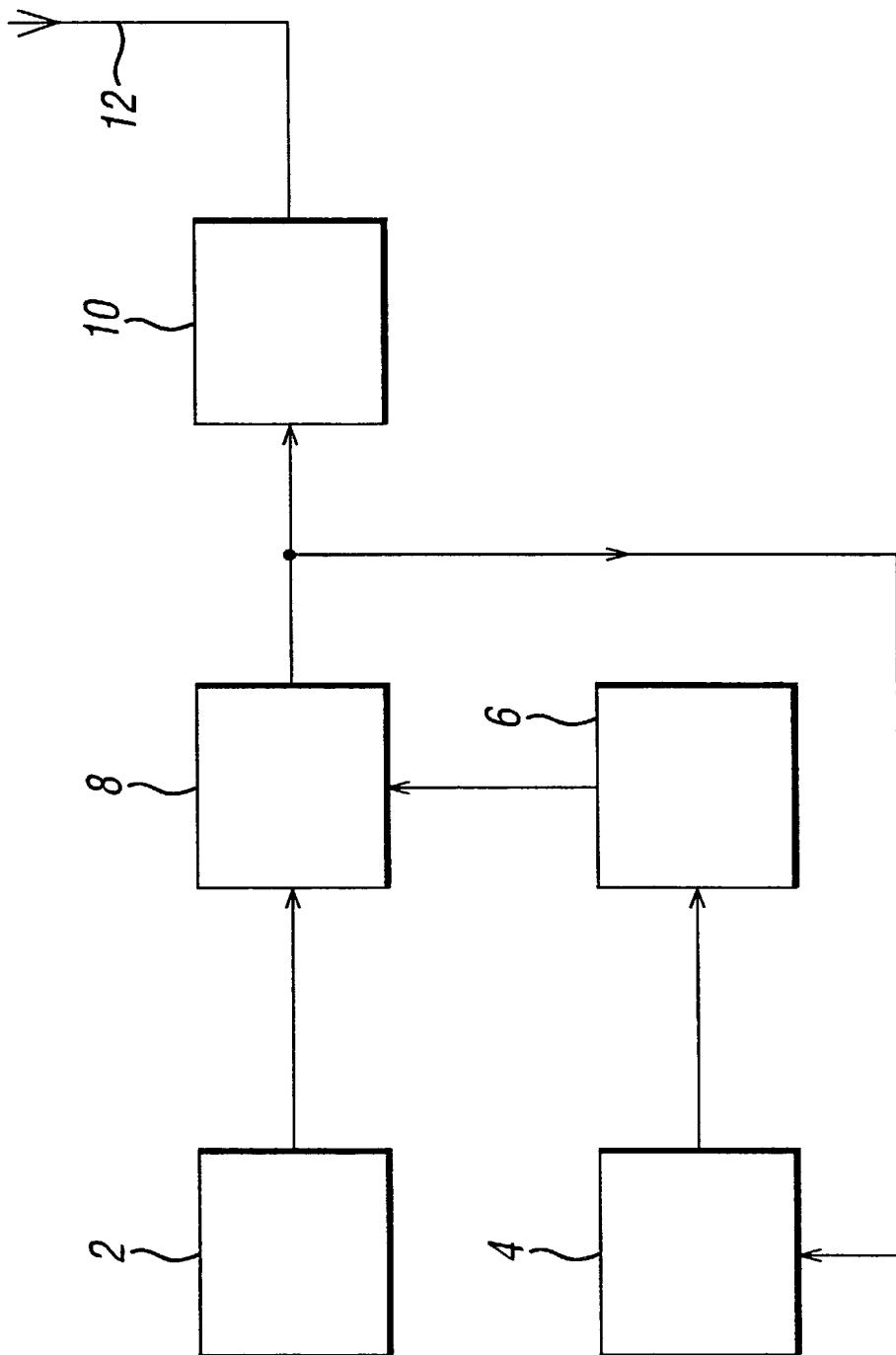
CLAIMS

1. A video signal error detection system for use in a receiver having a decoder for receiving encoded video signals produced by an encoder in a transmitter, the encoder being
5 selectively operative to transmit only differences between selected macroblocks in successive frames when a specific difference criteria between said successive blocks is not exceeded, the detection system comprising a first comparator for comparing macroblocks in successive frames in the output signal from said decoder, applying said specific difference criteria to provide an indication of whether inter-frame prediction should apply or not, and
10 a second comparator for comparing the output from the first comparator with an output from the decoder indicative of whether or not the last macroblock received was in inter-frame prediction format or not and operable to generate an error signal when a divergence is detected.
- 15 2. A system according to Claim 1, including an error concealment circuit responsive to the output of the decoder and buffer to recover corrupted data when the second comparator indicates an error.
3. A system according to Claim 1 or to Claim 2, wherein the first comparator acts as a
20 mode decision circuit capable of generating one of three outcomes namely, inter-frame prediction, no inter-frame prediction and unknown.
4. A system according to Claim 3, wherein the mode decision circuit responds to each

macroblock of each frame from the output from the decoder to determine a mean value for the pixels and responds to the difference A between the reconstructed values of the pixels in said macroblock and the said mean value, the difference B between the reconstructed values of the pixels of the present macroblock and the reconstructed values of the pixels of the corresponding macroblock of the immediately preceding frame and the error margin E to provide a first outcome if $A < B - E$ a second outcome if $B - E < A < B + E$ and a third outcome if $B + E < A$.

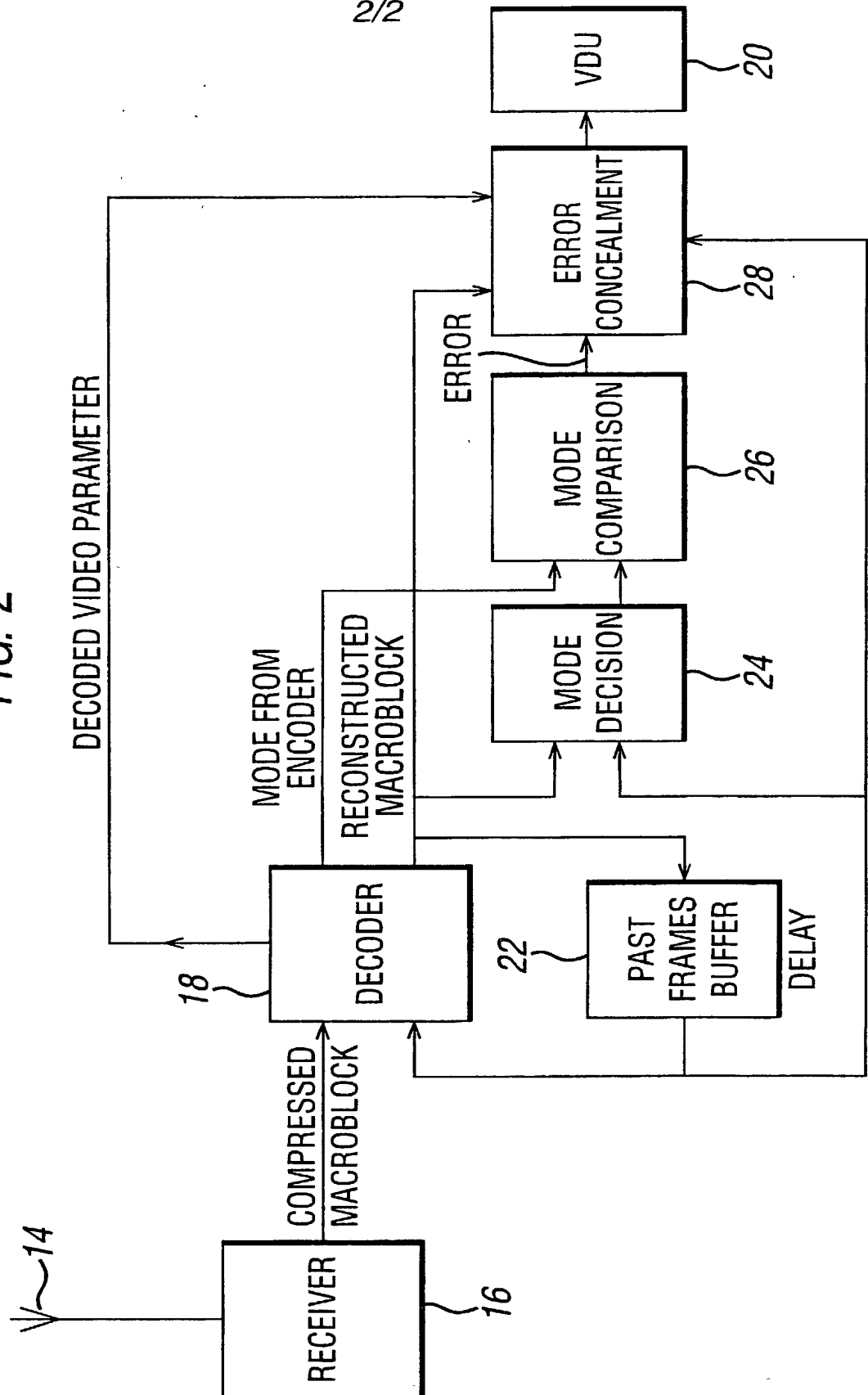
5. A system according to Claim 2, wherein the error concealment circuit acts to replace each corrupted macroblock with a corresponding macroblock in the immediately preceding frame.

FIG. 1



2/2

FIG. 2



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Declaration and Power of Attorney

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **Video Signal Error Detection Systems**

☒ is attached hereto

OR

☐ was filed on _____ and granted Application Serial Number _____.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by an amendment, if any, specifically referred to in this oath or declaration.

I acknowledge the duty to disclose all information known to me which is material to patentability as defined in Title 37, Code of Federal Regulations, 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

European Application No.99306911.1 filed August 31, 1999

I hereby claim the benefit under Title 35, United States Code, 120 of any foreign application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

International

Patent Application No.
PCT/GB00/01844

Filing Date
15TH May 2000

Status
Pending

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorney(s) with full power of substitution and revocation, to prosecute said application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith:

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I hereby authorize these attorneys to insert in the above blanks the filing date and application serial no. when known.

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Full name of sole inventor: Faruk Mehmet Omer Eryurtlu

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